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DOMINION OF CANADA.
EXPERIMENTAL FARMS.

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**HOW TO PROTECT FRUITS, VEGETABLES AND ORNAMENTAL PLANTS FROM
 INSECTS AND FUNGOUS DISEASES.**

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Much injury is done to fruit and vegetable crops every year by the ravages of insects and fungous diseases, and ornamental plants also suffer greatly. A large part of this injury could be prevented if everyone who grew these crops would use the methods of controlling them which are given in this pamphlet. In some cases the results are not so apparent as in the killing of potato beetles, and fruit growers are sometimes discouraged and decide to stop spraying and take their chances. This often happens after there has been a year when there has been little or no Apple Scab, when the man who does not spray has about as clean fruit as he who has done so. But the experience of the most successful fruit growers is that it does not pay to take chances, and that the best results follow, taking one year with another, when spraying is done every year. The pests of the garden can nearly all be controlled by poisons or sprays of some kind, but to be effective they must be given at the proper time and the work must be done thoroughly. Several formulae are recommended in this circular for the same purpose. This is done because in the country, or in small towns, it is often much easier to get some materials than others.

PLANT.	1ST APPLICATION.	2ND APPLICATION.	3RD APPLICATION.
APPLE. Scab or black spot fungus, sooty blotch, black rot, codling moth, leaf-eating caterpillars, borers, blister mite, curculio, apple aphid, scale insects.	<i>Lime-sulphur wash or Poisoned Bordeaux.</i> Just as leaf buds are opening. <i>(Important.)</i>	<i>Poisoned Bordeaux or Lime-sulphur wash.</i> Just before blossoms open. <i>(Important.)</i>	<i>Poisoned Bordeaux or Lime-sulphur wash.</i> As soon as blossoms fall. <i>(Important.)</i> From one to three more sprayings may be necessary to control the apple scab, depending on the season and prevalence of the disease. <i>Alkaline wash.</i> For borers at end of May.
	<i>Nicotine sulphate, Kerosene emulsion or Whale-oil soap</i> just when buds break and eggs are hatched for aphid; again in late May or June when young scale insects hatch. Nicotine sulphate, if used mixed with the Lime Sulphur wash, will kill many of the aphid. For oyster-shell scale, spray trees late in autumn with <i>Lime wash</i> , two coats, applying the second as soon as first is dry. <i>Lime Sulphur wash</i> for San Jose Scale.		

PLANT.	1ST APPLICATION.	2ND APPLICATION.	3RD APPLICATION.
CHERRY. Rot, leaf diseases and injurious insects. Cut out and burn Black Knot six inches below affected part whenever seen.	<i>Lime-sulphur wash</i> or <i>Poisoned Bordeaux.</i> Before flower buds open. <i>Kerosene emulsion</i> or <i>Whale-oil soap solution.</i> For aphid.	<i>Poisoned Bordeaux</i> or <i>Lime-sulphur wash.</i> When fruit has set. (Important.)	<i>Poisoned Bordeaux</i> or <i>Lime-sulphur wash.</i> 10-15 days later. (Important.)
If a late brood of the cherry or pear slug appears, spray with Arsenate of lead or Paris green.			
CURRENT. Leaf spot, "current worm," current aphid.	<i>Paris green.</i> When worms appear.	<i>Hellebore.</i> When fruit is fully formed.	<i>Bordeaux.</i> After fruit is picked, and about two weeks later.
For aphid, <i>Kerosene emulsion</i> , <i>Whale-oil solution</i> , or <i>Tobacco and soap wash.</i>			
GOOSEBERRY. Mildew, leaf spot, "current worm."	<i>Copper sulphate</i> or <i>Lime-sulphur wash.</i> Just before leaves open.	<i>Poisoned Bordeaux</i> or <i>Potassium sulphide</i> (1 oz. to 2 galls. water) or <i>Lime-sulphur wash.</i> Just before flower buds open.	<i>Poisoned Bordeaux—Hellebore.</i> <i>Lime-sulphur wash</i> or <i>Potassium sulphide.</i> when fruit has set, and about ten days later for American Gooseberry Mildew. (Important.)
Spraying for American Gooseberry Mildew is not always effectual. Affected twigs should be cut off and burned.			
GRAPE. Mildew, rot, anthracnose, "thrip" (or leaf-hopper).	<i>Bordeaux.</i> When third leaf shows. (Important.)	<i>Bordeaux.</i> Just before blossoms open. (Very important.)	<i>Bordeaux.</i> As soon as fruit has set. <i>Kerosene emulsion.</i> For leaf-hopper. (Very important.)
Later sprayings, the first about ten days after the third, may be necessary. When rot is prevalent, it is best to spray a few hours before rain than afterwards, to ensure destruction of spores germinating very soon after rain.			
PEACH, APRICOT, NECTARINE. Rot, leaf-curl, shot-hole, scab, curculio, bud moth, bark borer, scale.	<i>Lime-sulphur wash.</i> Before buds swell. (Very important.)	<i>Arsenate of lead.</i> For curculio.	<i>Self-boiled lime—sulphur wash</i> about one month after fruit has set, and again about one month before fruit ripens. Affected trees should be.
Spraying will not control promptly removed.			
Yellows or Little Peach.			
PEAR. Scab, cracking, leaf blight, codling moth, blister mite, "slug," pear psylla.	<i>Copper sulphate.</i> Before buds start. (Important.)	<i>Poisoned Bordeaux.</i> Just before blossoms open. (Important.)	<i>Poisoned Bordeaux.</i> Soon after blossoms fall. (Important.) If disease is showing, spray 10-12 days later and again in two weeks.
For pear psylla, <i>Kerosene emulsion</i> or <i>Whale-oil soap</i> just after leaves expand, and again a week. If late brood of "Slug" appears use <i>Arsenate of lead</i> or <i>Paris green.</i>			
PLUM. Rot, scab, or blight, shot-hole, bud moth, curculio, aphid.	<i>Lime-sulphur wash</i> or <i>Copper sulphate</i> and <i>Arsenate of lead.</i> or <i>Paris green.</i> Before buds open. (Important.)	<i>Lime-sulphur wash</i> (1-40) or <i>Poisoned Bordeaux.</i> (3-4-40) Very soon after blossoms have fallen. (Important.) For curculio.	<i>Lime sulphur</i> (1-40) or <i>Poisoned Bordeaux.</i> (3-4-40) 12-15 days later and again in about two weeks. <i>Kerosene emulsion.</i> <i>Whale-oil soap,</i> or <i>Tobacco and soap wash.</i> For aphid.

PLANT.	1ST APPLICATION.	2ND APPLICATION.	3RD APPLICATION.
ROSE. Mildew, leaf blotch, "rose slug," "rose thrip," red spider.	Mildew in Greenhouse. Paint heating pipes with paste made of equal parts of sulphur, lime and water. For red spider dust under sides of leaves with dry sulphur or mix sulphur with insecticides for aphids or thrips. Treat at short intervals until eradicated.	Leaf Blight. Arsenical Copper carbonate. "Rose Slug." Arsenate of lead or Paris green (1 oz. in 12 gals. water) or <i>Hellebore</i> .	"Rose Thrip." Aphids. Nicotine. Nicotine Sulphate. Kerosene emulsion, or Whale-oil soap. When "thrip" or aphids appear.
RASPBERRY, BLACK-BERRY, DEWBERRY. Anthracnose, rust.	Copper sulphate Before buds burst.	Bordeaux. 10-15 days later.	Bordeaux. Soon after old canes are cut out.
Dig out and burn badly diseased plants.			
STRAWBERRY. Rust or leaf spot, white grubs.	Bordeaux. Just before blossoms open.	Bordeaux. soon after picking season, or burn foliage.	Bordeaux. 10-15 days later.
To control white grubs, grow strawberries in one-year system.			
BEAN. Anthracnose, cutworms.	Use clean seed, free of disease. Spraying is not very effectual.	Bordeaux. When rough leaves appear.	Bordeaux. At intervals, 8-12 days later.
For cutworms, <i>Poisoned bran</i> .			
CABBAGE, CAULIFLOWER, ONION, RADISH, TURNIP. Flea-beetle, caterpillars, aphids, root-maggots, cut-worms.	Paris green, or arsenate of lead. For flea-beetle immediately plants appear above the ground. For root-maggots, Tar-felt paper discs around stems of cauliflowers and cabbage. These should be put on immediately the plants are set out to prevent the fly from laying her eggs on the ground near the stem. The discs should lie flat on the ground and fit close to the stem. Insect powder or <i>Hellebore</i> in water poured about the roots at intervals of a week, and Carbolic emulsion have some effect in controlling root maggots of onions and radishes. Cut-worms—Use <i>Poisoned bran</i> for cut-worms. If scattered on surface of soil near plants to be protected the cut-worms will eat it in preference to the plants, and die.	Pyrethrum—dry mixture. For cabbage worms.	Kerosene emulsion or Soap washes. For aphids.
POTATO. Scab, rhizoctonia, blight and rot, in cets.	Soak tubers in solution of Corrosive sublimate or Formalin For scab.	Paris green. 8 ozs. or more to 40 galls. water; or Arsenate of lead, 3 lbs. to 40 galls. water or preferably 8 ozs. Paris green and 1 lb. Arsenate of lead to 40 galls. water. For Colorado potato beetle	Poisoned Bordeaux. For rot and beetles. From 15th July till end of season, 2 weeks apart. Keep foliage covered. Bordeaux for flea-beetle.
CELERY. Early and late blight.	Keep foliage constantly covered with Bordeaux throughout the season.		
ASPARAGUS. Rust.	Dust flowers of sulphur over and through the plants before the rust makes its appearance in summer. Two applications should be made each at the rate of about 150 lbs. per acre. The sulphur will adhere better if the plants are first sprayed with Whale-oil soap and water or resin sticker.		
TOMATO. Rot, blight, cut-worms.	Bordeaux. On plants in seed beds. Use <i>Poisoned bran</i> for cut-worms.	Bordeaux. On first appearance of rot.	Bordeaux. When necessary.

INSECTICIDES.

INTERNAL POISONS (FOR BITING INSECTS).

PARIS GREEN.

Paris green..... 1 lb.
 Unslaked lime..... 1 lb.
 Water..... 100 gallons.
Dry mixture.—1 lb. Paris green with 50 lbs. flour, land plaster, slaked lime or any other perfectly dry powder.
Poisoned Bran. for cutworms.—Mix $\frac{1}{2}$ lb. of Paris green thoroughly with 50 lbs. of slightly moistened sweetened bran.

ARSENATE OF LEAD.

Arsenate of lead..... 2 to 3 lbs.
 Water..... 40 gallons.
 Mix thoroughly before using.

HELLEBORE.

(Keep in air tight vessel.)

White hellebore..... 1 oz.
 Water..... 2 gallons.
Or to be dusted undiluted over attacked plants.
For root maggots use 2 ounces of hellebore to 1 gallon water.

CARBOLIC EMULSION.

Hard soap, well sliced..... 1 lb.
 Crude Carbolic acid..... 1 pint.
 Boiling water..... 1 gallon.
 Dissolve the soap in water, then add the acid and churn violently with dasher. Before using dilute to 25 gals.

CONTACT POISONS (FOR SUCKING INSECTS.)

PYRETHRUM (OR INSECT POWDER).

(Keep in air tight vessel.)

Pyrethrum powder (fresh)..... 1 oz.
 Water..... 3 gallons.
Dry mixture.—Mix thoroughly 1 part by weight of Insect Powder with 4 of cheap flour, and keep in a close vessel for 24 hours before dusting over plants attacked.

*NICOTINE SULPHATE:

(Containing at least 40% nicotine).

(FOR APHIS)

Nicotine sulphate..... 1 oz.
 Water..... 6 $\frac{1}{2}$ gals. or 1 part to 500 to 1,000 of water.
 It should be more concentrated for some species.

NICOTINE (FOR ROSE THRIP AND APHIS.

Nicotine..... 1 teaspoonful.
 Water..... 1 gallon.

KEROSENE EMULSION (FOR APHIS, SCALE AND OTHER SUCKING INSECTS.

Kerosene (coal oil)..... 2 gallons.
 Rain water..... 1 gallon.
 Soap..... $\frac{1}{2}$ lb.

Dissolve soap in water by boiling; take from fire, and, while hot, turn in kerosene and churn briskly for 5 minutes. For use, dilute with 9 parts of water so that the above 3 gallons of stock emulsion will make 30 gallons of spraying mixture.

FLOUR EMULSION (FOR APHIS, SCALE AND OTHER SUCKING INSECTS.)

Kerosene..... 1 quart.
 Flour..... 8 ozs.
 Water..... 2 gallons.

Stir together the flour and kerosene, then add the water, and churn violently for five minutes. To be used at once.

WHALE-OIL SOAP.

For brown or black aphis..... 1 lb. in 4 gallons water.
 For scale-insects (young)..... 1 lb. in 5 gallons "
 For green aphis or thrips..... 1 lb. in 6 gallons "

*A preparation of this known as "Black Leaf 40" is offered for sale in Canada.

TOBACCO AND SOAP WASH (FOR AFRIS AND OTHER SUCKING INSECTS).

Soak in hot water for a few hours 10 lbs. of tobacco leaves (home-grown will do); strain off and add 2 lbs. of whale-oil soap. Stir until all is dissolved, and dilute to 40 gals. Apply early and two or three times at short intervals.

LIME WASH (FOR OYSTER SHELL SCALE).

Unslaked lime..... 1 to 2 lbs.
Water..... 1 gallon.
Strain through sacking before spraying. To be applied late in autumn.

LIME-SULPHUR WASH (FOR SAN JOSE SCALE AND FUNGUS DISEASES).

Lime..... 20 lbs.
Sulphur, powdered..... 15 lbs.
Water to make..... 40 gallons.

Slake the lime with only enough water to do it thoroughly. Add the sulphur by dusting it over the lime while slaking; stir well and boil for at least an hour, adding only so much hot water as is necessary for easy stirring. When thoroughly cooked, strain through sacking, and apply hot.

COMMERCIAL LIME SULPHUR.

When commercial concentrated lime sulphur wash is used, it should be diluted for use, when there are no leaves on the trees, to 1 gallon of the concentrated wash to about 5 gallons of water varying with the intensity of the wash. For use when there is foliage the lime-sulphur should be diluted to 1 gallon of the concentrated wash to 35 to 40 gallons of water. Arsenate of lead is the best poison to use with the lime-sulphur wash. Arsenite of lime will injure foliage.

CONCENTRATED LIME SULPHUR.

This can be made at home instead of buying the commercial lime sulphur. With a formula of 50 lbs. of fresh lime, 100 lbs. sulphur to 40 gallons of water. Heat the water to near boiling then put in the lime and when it is slaked, add the sulphur having first broken any lumps and screened it. Keep the mixture boiling well for an hour when, if it has been frequently stirred, it should be in condition. Then replace water lost in boiling to make up forty gallons. Strain through a 20 to the inch mesh and store in barrels until needed. If barrels are not closed, covering the surface with oil will prevent evaporation. This is usually a little weaker than the commercial washes.

USE OF THE HYDROMETER IN DETERMINING PROPER DILUTION OF CONCENTRATED LIME SULPHUR.

The hydrometer which can be obtained from most druggists with specific gravity readings, is a small instrument costing about \$1 which it is very desirable to use when lime sulphur is used as a summer spray. As different concentrated washes vary somewhat in strength, and in dealing with tender foliage it is very essential to be sure of the strength of the solution. To test the strength of the solution with the hydrometer, the latter is put in it when it is cool and any sediment has gone to the bottom, and the reading noted. The reading will indicate the density of the concentrate. To obtain the total dilutions required, the decimal of the reading of the concentrate is divided by the decimal of the strength required. For summer strength the reading should be 1.000 to 1.01.

SELF-BOILED LIME SULPHUR (ESPECIALLY FOR BROWN ROT AFFECTING PEACHES).

Unslaked lime..... 8 pounds.
Sulphur (flour or flowers)..... 8 pounds.
Water..... 40 gallons.

Slake the lime in a barrel with a little cold water. After screening to break up lumps, put the sulphur in another vessel and add enough water to make a thin paste. Now pour the sulphur paste, or even the dry sulphur, slowly into the barrel containing the slaking lime. Stir the mass thoroughly and add enough cold water to keep the lime from sticking to the bottom of the barrel and to ensure thorough slaking, but avoid using more water than is necessary until the lime is slaked when enough water should be at once added to cool the mass. Strain before spraying and add enough water to make up to the proportion in the formula. It is found that a desirable amount of heat is obtained by slaking 24 lbs. of lime with 24 lbs. sulphur at one time.

ALKALINE WASH (FOR BORERS.)

Soft soap reduced to the consistency of thick paint by the addition of a strong solution of washing soda in water. If applied with a brush about the 1st of June on the morning of a warm day, this will dry in a few hours and form a tenacious coating not easily dissolved by rain.

If 1 pint of crude carbolic acid to the gallon of wash be added, it will make it more effective.

FUNGICIDES.

BORDEAUX MIXTURE (For Fungi.)

Copper sulphate (Bluestone).....	4 lbs.
Unslaked lime.....	4 lbs.
Water (1 barrel).....	40 gallons.

When spraying peach and plum foliage which may be injured by the ordinary formula, it is safer to use Bordeaux mixture in the proportion of 3 lbs. copper sulphate, 4 lbs. lime to 40 gallons water.

Dissolve the copper sulphate (by suspending it in a wooden or earthen vessel containing 4 or 5 or more gallons of water). It will dissolve more quickly in warm water than in cold. Slake the lime in another vessel. If the lime, when slaked, is lumpy or granular, it should be strained through coarse sacking or a fine sieve. Pour the copper sulphate solution into a barrel, or it may be dissolved in this in the first place; half fill the barrel with water; dilute the slaked lime to half a barrel of water, and pour into the diluted copper sulphate solution, then stir thoroughly. It is then ready for use. (Never mix concentrated milk of lime and copper solution.)

A stock solution of copper sulphate and milk of lime may be prepared and kept in separate covered barrels throughout the spraying season. The quantities of copper sulphate, lime and water should be carefully noted. Bordeaux mixture deteriorates with age and should be used as soon as made.

To test Bordeaux mixture, let a drop of ferrocyanide of potassium solution fall into the mixture when ready. If the mixture turns reddish-brown, add more milk of lime until no change takes place.

POISONED BORDEAUX MIXTURE (FOR FUNGI AND LEAF-EATING INSECTS.)

To the 40 gallons of Bordeaux mixture prepared as above, add 4 to 8 ounces of Paris green, or 3 lbs. of arsenate of lead.

FOR POTATO BLIGHT AND COLORADO POTATO BEETLES.

Instead of 4 lbs. copper sulphate, use 6 lbs.; and for potato beetles 8 oz. or more of Paris green, or 3 lbs. arsenate of lead, or preferably 8 oz. Paris green and 1½ lbs. arsenate of lead to 40 gallons water.

SODA-BORDEAUX (BURGUNDY MIXTURE) FOR POTATO BLIGHT AND ROT.

Copper sulphate (Bluestone).....	6 lbs.
Washing soda (Carbonate of soda).....	7½ lbs.
Water (1 barrel).....	40 gallons.

Dissolve copper sulphate as for Bordeaux mixture. Dissolve 7½ lbs. washing soda in 4 gallons water. Pour the copper sulphate solution into a barrel, half fill the barrel with water, then stir in the solution of washing soda, and finally fill the barrel with water. It is now ready for use. The Soda-Bordeaux adheres better to the foliage when freshly made than the ordinary Bordeaux mixture, but it deteriorates rapidly in this respect and must be used as soon as made. If left standing for 24 hours it will have lost nearly all of its adhesiveness. The Soda-Bordeaux is not recommended in preference to the ordinary Bordeaux mixture, but where lime cannot be obtained it may be used with good results. Furthermore, on account of its freedom from gritty matter there is less likelihood of the nozzles becoming clogged when it is used. As washing soda is more expensive than lime, this mixture costs a little more than the ordinary Bordeaux mixture.

NOTE.—If the Soda-Bordeaux is used for spraying fruit trees, the formula is copper sulphate, 4 lbs.; washing soda, 5 lbs.; water, 40 gallons. Arsenical poisons should not be used with Soda-Bordeaux, as they may injure the foliage. Care should be taken to have exact quantities of washing soda and copper sulphate, as an excess of washing soda might result in injury to foliage.

RESIN STICKER.

Resin.....	8 lbs.
Washing soda (Sal. soda, Carbonate of soda).....	4 lbs.
Water.....	4 gallons.

Dissolve 4 pounds of washing soda in 4 gallons of hot water and then bring the solution to a boil. In another vessel melt 8 lbs. resin. When the latter is melted, pour it slowly into the boiling soda solution until all the resin is added, stirring it well at the same time. After all the resin is added, continue boiling for one hour or until a homogeneous mixture is obtained. If properly made, this will mix well with water or Bordeaux mixture. As some water will be evaporated in boiling, sufficient should be added to make the stock mixture 4 gallons.

Two quarts of the above stock mixture should be used with 40 gallons of Bordeaux mixture.

Resin sticker may be added to Bordeaux mixture (2 quarts to 40 gallons) and makes it adhere better to foliage.

COPPER SULPHATE SOLUTION (FOR FRUIT TREES BEFORE BUDS BURST.)

Copper sulphate (Bluestone).....	1 lb.
Water.....	20 gallons.

As soon as dissolved it is ready for use. Use only before the buds open.

To destroy WILD MUSTARD, spray before bloom, with 5 lbs. in 20 gallons.

AMMONIACAL COPPER CARBONATE.

Copper carbonate.....	5 oz.
Ammonia.....	2 quarts.
Water (1 barrel).....	40 gallons.

Dissolve the copper carbonate in the ammonia. The ammonia and concentrated solution should be kept in glass or stone jars, tightly corked. It is ready for use as soon as diluted with the 40 gallons water. To be used when Bordeaux cannot be applied on account of staining the fruit.

CORROSIVE SUBLIMATE AND FORMALIN SOLUTIONS.

FOR POTATO SCAB OF RHIZOCTONIA, soak the tubers before planting, either—

- I. For 3 hours in a solution of Corrosive Sublimate 1 oz. in water 12 gallons. When dry cut up for planting.
- II. For 2 hours in a solution of commercial formalin (Formaldehyde) 8 oz. in water 15 gallons; or 1 oz. in water, 2 gallons.

Formalin has the advantage of being neither poisonous nor corrosive, while Corrosive Sublimate is a fatal poison if taken internally. It also corrodes metals. The solution should therefore be made in wooden or glazed vessels. It appears, however, to be more effective than formalin. Tablets may be procured at any druggist of such a size that one dissolved in a quart of water gives a solution of 1 to 2000. All treated seed potatoes should be planted, and any solution left over should be poured into a hole in the ground. Selection of sound tubers is desirable as treatment is not always effectual.

N.B.—All the above recommendations are dependent on weather. If heavy rain falls immediately after spraying, applications should be repeated, but spraying shortly before rain is better than spraying after rain.

Always wash out thoroughly with clean water all pumps and nozzles immediately after using. The gallon referred to above is the Imperial gallon.

Several different formulae are recommended in some cases for the same insects or diseases. This is to make it easier for those in out of the way places to obtain at least one good insecticide or fungicide.



CAULIFLOWERS—CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.
Protected from root maggots by tar-felt paper discs. Unprotected.



POTATOES—CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.
Sprayed with Bordeaux Mixture to prevent Late Blight. No Bordeaux Mixture.